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Draft
Sampling and Analysis Plan for the BMX Track at Operable Unit 5 Libby Asbestos Superfund Site Libby, Montana

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U.S. Environmental Protection Agency
Region 8
Denver, CO

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Approval Page

This Sampling and Analysis Plan for the BMX track at Operable Unit 5 of the Libby Asbestos Superfund Site has been prepared by the U.S. Environmental Protection Agency, Region 8, with technical support from Syracuse Research Corporation and CDM, and is approved without conditions.

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Paul Peronard, EPA Team Leader Date

Distribution List

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List of Acronyms

BMX	Bicycle Motocross
CCMA	Clear Creek management Area
FSP	Field Sampling Plan
ISO	International Organization for Standardization
LA	Libby Amphibole
SAP	Sampling and Analysis Plan
OU	Operable Unit
QAPP	Quality Assurance Project Plan
TEM	Transmission Electron Microscopy
TWF	Time-Weighting Factor
UR	Unit Risk

1 INTRODUCTION

This Sampling and Analysis Plan (SAP) describes the collection and analysis of air samples collected at a Bicycle Motocross (BMX) track located in Operable Unit 5 (OU5) of the Libby Asbestos Superfund Site. This SAP contains a field sampling plan (FSP) and quality assurance project plan (QAPP). This SAP has been developed in accordance with the EPA Requirements for Quality Assurance Project Plans (EPA 2001) and the Guidance on Systematic Planning Using the Data Quality Objectives Process – EPA QA/G4 (EPA 2006). The SAP is organized as follows:

Section 1 – Introduction
Section 2 – Site Description and History
Section 3 –Data Quality Objectives
Section 4 – Sampling Program
Section 5 – Laboratory Analysis Requirements
Section 6 – References

1.1 Objectives

The objective of this SAP is to collect data that will be adequate to characterize the level of asbestos exposure that occurs in individuals who ride motorized vehicles at the BMX track in OU5.

1.2 Project Schedule and Deliverables

Two sampling events of one day each are expected to be conducted in the interval between March and August 2008.

2 SITE DESCRIPTION AND HISTORY

Libby is a community in northwestern Montana located near an open pit vermiculite mine. The mine began limited operations in the 1920's and was operated on a larger scale by the W. R. Grace Company from approximately 1963 to 1990. Studies at the site reveal that the vermiculite from the mine contains amphibole-type asbestos, referred to in this report as Libby Amphibole (LA). Epidemiological studies at the site revealed that workers at the mine had an increased risk of developing asbestos-related lung disease (McDonald et al. 1986, Amandus and Wheeler 1987, Amandus et al. 1987a,b, Sullivan 2007, Rohs et al. 2007). In 2003, Peipins et al. demonstrated radiographic abnormalities in 17.8% of the general population of Libby including former workers, family members of workers, and individuals with no specific pathway of exposure. Although the mine has ceased operations, historic or continuing releases of LA from mine-related materials could be serving as a source of on-going exposure and risk to current and future residents in the area. Since 1999, EPA has conducted sampling and cleanup activities at the Site related to asbestos-related health problems in the Libby population. The site was listed on the Superfund NPL in February 2002.

The Site has been subdivided into seven operable units to facilitate a phased cleanup approach. Operable Unit 5 (OU5) is defined geographically by the parcel of land that includes the former Stimson Lumber Mill. Historical information regarding the Stimson property suggests that asbestos-containing vermiculite products were used at, or transported to, the area at various times. The BMX track (Mill Pond MotoXTrack) is located in the southeast corner of OU5. The track area measures approximately 140,000 square feet (about 3.2 acres). The track is currently used by the public for recreational activities.

2.1 Previous Characterization Activities

During a 2002 contaminant screening study (CDM 2002), an extensive soil sampling effort was conducted within the boundaries of the former Stimson Lumber Company property. Of the 127 soil samples collected from the property, 1 sample was collected from the BMX track area. This sample measured non-detect for LA asbestos by phase contrast microscopy using the visual area estimation technique (PLM-VE).

In response to redevelopment plans by the Lincoln County Port Authority, additional soil sampling was conducted at the BMX track in May 2004 (CDM 2004). A site visit to the area prior to sampling in 2004 revealed that construction of the track had begun before the area was sampled. The area had been graded by heavy equipment for the track outline. Twenty-one field samples and one field duplicate were collected from the area. Of the 21 field samples collected, eight were surface samples collected from 0-1" below ground surface (bgs), eight were surface samples collected from 2-6" bgs, three were collected from randomly selected stockpiles formed during the re-grading activities at 2-6" below the surface, and two were subsurface samples collected from 6-12" bgs. Vermiculite was observed in four of the samples collected during this investigation. Results of PLM-VE for LA asbestos were all non-detect. Since the last sampling effort, the BMX track area has been re-graded. Soil scraped during this process was used to construct jumps at the track.

3 DATA QUALITY OBJECTIVES

The DQO process is a series of planning steps that are designed to ensure that the type, quantity, and quality of environmental data used in decision-making are appropriate for the intended purpose. EPA has issued guidelines to help data users develop site-specific DQOs (EPA 2006). These guidelines were followed for the development of the DQOs presented in this section.

The DQO process specifies project decisions, the data quality required to support those decisions, specific data types needed, data collection requirements, and analytical techniques necessary to generate the specified data quality. The DQO process consists of seven steps; output from each step influences the choices that will be made later in the process. These steps include:

1. State the problem
2. Identify the decision
3. Identify the inputs to the decision
4. Define the study boundaries
5. Develop a decision rule
6. Specify tolerable limits on decision errors
7. Optimize the design

These steps are implemented below.

3.1 Step 1 – State the Problem

The problem to be addressed in this effort is that area residents are presently using the BMX track for recreational activities. Because LA has not been observed in any soil samples from the track area, EPA believes that use of the track is safe. However, BMX riding is expected to cause the release of high levels of dust into air, and no data have been collected to confirm that levels of LA in air are low during bike riding activities. Therefore, the purpose of this SAP is to collect reliable data on the level of LA in air at the BMX track under typical use patterns.

3.2 Step 2 – Identify the Decision

The decision to be made is whether or not EPA needs to take any action at the BMX track to ensure health protection for area residents who use the track.

Note: In making this decision, it is important to emphasize that the basis for assessing human health risk from cancer due to asbestos exposure is currently undergoing Agency review, and the approach may be revised in the future as new methods are developed and as new toxicity data on asbestos are obtained. In addition, EPA has not yet developed a method for assessing non-cancer risks from inhalation exposure to asbestos. Thus, all evaluations of public health protectiveness that are based on currently available risk assessment methods should be viewed as interim, and these interim decisions may be revised in the future as methods and data for assessing the cancer and non-cancer risks of asbestos are improved.

3.3 Step 3 – Identify the Inputs to the Decision

The data needed to achieve the objective of this effort consist of reliable and representative measurements of LA concentrations in the air breathed by area residents while riding on the BMX track. For convenience, collection of personal air monitoring samples from individuals who are engaged in activities that may cause release of asbestos from soil into air is referred to as “activity-based sampling” (ABS).

3.4 Step 4 – Define the Boundaries of the Study

Spatial Bounds

The current sampling effort is restricted to the BMX track within OU5.

Temporal Bounds

The releasability of LA from soil to air is expected to vary as a function of time (season) due to variations in soil moisture content and meteorological variables. Therefore, adequate characterization of LA levels in ABS air samples requires collection of samples at several times during the part of the year when riding activities occur (from ~March to ~October). It is expected that highest levels will be observed in late summer when soils tend to be at their driest, although this may vary with conditions. For this reason, sampling will occur at two time periods: late spring and mid- to late summer.

Activity bounds

Release of LA from soil is expected to be influenced by the level of energy associated with the soil disturbance, with higher energy levels being expected to result in increased airborne concentrations of dust and, possibly, LA. Activity levels for this sampling effort will be consistent with those commonly encountered during active use of the track by multiple BMX riders.

3.4 Step 5 – Develop Decision Rules

EPA has not determined a final decision rule for assessing protectiveness at the Libby site, but it is expected that the rule which will ultimately be adopted will take a form similar to the following:

> If the level of risk to riders at the BMX track at OU5, when combined with the level of risk which applies to the same individuals from other applicable exposure pathways, does not exceed a cancer risk of 1E-04 or a non-cancer Hazard Quotient (HQ) of 1.0, then risks at the track will be considered acceptable. If the total risk exceeds a cancer risk of 1E-04 or an HQ of 1.0, then the feasibility of further reducing exposure from the outdoor air pathway and/or the other applicable exposure pathways shall be assessed.

At present, EPA has not developed a quantitative procedure for evaluating non-cancer risks, but has developed a method for quantification of cancer risk (IRIS 2007). The basic equation is:

$$\text{Risk}(i) = C(i) \cdot \text{TWF}(i) \cdot \text{UR}(i)$$

where:

Risk(i) = Risk of dying from a cancer that results as a consequence of exposure from specified exposure scenario "i"

C(i) = Average concentration of asbestos fibers in air (f/cc) during exposure scenario "i"

UR(i) = Unit Risk $(f/cc)^{-1}$ that is appropriate for exposure scenario "i"

TWF(i)= Time weighting factor for exposure scenario "i". This factor accounts for less-than-continuous exposure during the exposure interval.

As noted above, because of limitations in the current methods for assessing risks from asbestos, all decisions regarding residual risk levels are considered interim, and interim decisions may be revisited in the future as new methods and new data become available.

3.5 Step 6 – Specify Tolerable Limits on Decision Errors

In making decisions about the long-term average concentration of LA in outdoor air and the level of health risk associated with that exposure, two types of decision errors are possible:

- A false negative decision error would occur if a risk manager decides that exposure to LA in outdoor air is not of significant health concern, when in fact it is of concern.

- A false positive decision error would occur if a risk manager decides that exposure to LA in outdoor air is above a level of concern, when in fact it is not.

EPA is most concerned about guarding against the occurrence of false negative decision errors, since an error of this type may leave humans exposed to unacceptable levels of LA in outdoor air. For this reason, it is anticipated that decisions regarding this pathway will be based not only on the best estimate of the long term average concentration, but will also consider the 95% upper confidence limit (UCL) of the long-term average concentration. Use of the UCL to estimate exposure and risk helps account for limitations in the data, and provides a margin of safety in the risk calculations, ensuring that risk estimates are unlikely to be too low.

EPA is also concerned with the probability of making false positive decision errors. Although this type of decision error does not result in unacceptable human exposure, it may result in unnecessary expenditure of resources. For the purposes of this effort, the strategy adopted for controlling false positive decision errors is to seek to ensure that, if the exposure estimate based on the 95% UCL is above EPA's level of concern for this pathway, then the UCL is not larger than 3-times the best estimate of the mean. If the 95% UCL is at or above the range that is of potential concern, and the UCL is greater than 3 times the best estimate of the mean, then it will be concluded that there is a substantial probability of a false positive error and that more data may be needed to strengthen decision-making.

3.6 Step 7 – Optimize the Design for Obtaining Data

Estimating the Number of Samples

The method used to compute the UCL of a set of outdoor air samples depends on the statistical properties of the data set. If it is assumed that the variability between different samples is likely to be approximately lognormal, then the data set collected from a location or a set of similar locations may be approximated by a mixed Poisson lognormal (PLN) distribution. At present, the EPA has not established a method for quantifying the uncertainty in the mean of a data set drawn from a PLN distribution. However, it is known that the magnitude of the uncertainty depends on the number of samples, the variability of the underlying lognormal distribution, and the average number of LA particles counted in the analysis of each sample.

In the absence of an approved method for computing the UCL of a PLN data set, it is not yet possible to perform a quantitative analysis of decision error rates as a function of sample size. However, based on professional judgment and experience with other ABS data sets collected at the Libby site, it is expected that at least 20 samples are needed to ensure that the uncertainty range around the mean is within reasonable limits.

Estimating the Required Analytical Sensitivity

For the purposes of this effort, the analytical sensitivity that is needed for analysis of outdoor air samples is estimated in a series of steps, as follows:

1. Select a risk level of potential concern
2. Calculate the concentration of LA that corresponds to the selected risk level
3. Set the target analytical sensitivity such that, if the average concentration of LA were close to the concentration of concern, the analysis would yield a reliable quantification of the concentration

The level of potential concern selected for computing the analytical sensitivity for the BMX air pathway is a cancer risk of 1E-05 (1 in 100,000) or a non-cancer HQ of 0.1. These levels are 1/10 the total level of concern to EPA.

The concentration of LA in outdoor air that is associated with a risk level of 1E-05 is referred to as the risk-based concentration (RBC), and is calculated from the basic risk equations described above by solving for the concentration that yields a risk of 1E-05:

$$RBC = 1E\text{-}05 / (TWF \cdot UR)$$

Note that the RBC is expressed in terms of the type of fibers defined by the risk model. For example, the current EPA approach is based on phase contrast microscopy (PCM) fibers, which are defined as asbestos fibers longer than 5 um, thicker than 0.25 um, and with an aspect ratio greater than 3:1. For convenience, the fibers used in a risk model are called "risk-based fibers". In most cases, the risk-based fibers are only a sub-set of the total asbestos fibers present in air. The fraction of fibers that are risk-based is referred to as the "risk-based fraction" (RBF):

$$RBF = C(\text{risk-based}) / C(\text{total})$$

Combining yields:

$$RBC\ (\text{total LA f/cc}) = 1E\text{-}05 / (RBF \cdot TWF \cdot UR)$$

The value of RBF (the fraction of total LA fibers that are PCME fibers) for OU5 is not known, but data collected during ABS studies at other parts of the site indicate a value of about 0.3 to 0.5. Based on this, a value of 0.4 is assumed for these calculations.

Data on frequency and duration of riding activities are not currently available, but will be collected by surveying the activity patterns of track users (see Attachment 1). In the interim, based on professional judgment, the following activity parameters are assumed:

- Exposure time = 2 hours per day
- Exposure frequency = 30 days per year
- Exposure duration = age 15 to age 45

Based on this, the value of TWF is computed as follows:

$$TWF = 2 \text{ hr}/24 \text{ hr} \cdot 30 \text{ days}/ 365 \text{ days} = 0.0068$$

The value of UR based on exposure from age 15 to 45 is derived by extrapolation from the table of unit risk values reported in USEPA (1986). Based on the extrapolation, the value of unit risk for this scenario is:

$$UR = 0.0925 \text{ (PCM f/cc)}^{-1}$$

Based on these inputs, the concentration of LA in air that corresponds to a risk of 1E-05 in BMX riders is calculated as:

$$RBC = (1E\text{-}05) / (0.4 \cdot 0.0068 \cdot 0.0925) = 0.040 \text{ total LA f/cc}$$

In order to ensure that this concentration would be readily detectable if it were present, the target analytical sensitivity is set to a level about 1/4 the RBC:

$$S = 0.01 \text{ cc}^{-1}$$

As noted above, the EPA has not yet developed a method for evaluating non-cancer risks from asbestos, so it is not yet possible to compute an analogous level of concern for non-cancer effects. In the absence of data, it is tentatively assumed that the target analytical sensitivity that is adequate for evaluating cancer risk will also be sufficient for evaluating non-cancer risks. EPA toxicologists are currently working to develop an RfC for asbestos based on available data on LA and other forms of asbestos, and this assumption will be re-visited when an RfC is approved for use.

4 SAMPLING PROGRAM

4.1 Pre-Sampling Activities

Location specific information will be gathered by interviewing persons who participate in BMX activities to gain information required as input for risk calculations. The survey form to be used is provided in Attachment 1. All survey responses will be maintained in confidence and any release of the data will be coded such that the identity of the survey participants will remain private. Participation in the survey and the air sampling program will be strictly voluntary and conducted under informed consent.

Prior to beginning field sampling activities, a field planning meeting will be conducted, any required trainings will be conducted, and an inventory of equipment and supplies will be performed to ensure that all necessary supplies and equipment are available and in good working order.

4.2 Air Sampling Plan

Personal breathing zone air samples will be collected from area residents while engaged in their normal riding activities at the BMX track. In accord with USEPA guidance currently being developed (http://www.epa.gov/nerl/sots/SEAOES-review-draft.pdf), all samples collected will be observational only. During the course of the investigation there will be no intervention or manipulation of the normal riding procedures or activities that occur at the track. Because the level of LA in air is likely to vary considerable between riders (e.g., a rider following another is likely to have higher exposures that the lead rider), it is important to collect data from multiple individuals in order to ensure the data are representative. Therefore, for each sampling event, the goal is to collect data from 6-8 different riders. Assuming each rider participates in several rides per visit to the site, one sample should be collected per rider for each of two different rides. Thus, the number of personal air samples per event will be 12-16, and the total after two different events will be 24-32. This number of samples is expected to yield an estimate of the mean concentration that has acceptable uncertainty bounds.

Stationary air samples will also be collected for each sampling event from 5 stationary samplers positioned at approximately equal intervals around the track (10 total). The purpose of these samples is to evaluate the concentrations in air that might be breathed by site visitors while not engaged in riding activities. Because both the mean concentration and the between-sample variability of this type of sample is expected to be less than for the personal air samples, a total of 10 is expected to provide data of sufficient quality for exposure assessment.

4.3 Sample Collection Methodology

Standard Operating Procedure (SOP) EPA-Libby-01, Revision #1, March 2001 will be used for collection of both personal and stationary air samples during this effort. A copy of this SOP is presented in Attachment A. All air samples will be collected using cassettes that contain a 25 millimeter (mm) diameter mixed cellulose ester (MCE) filter with a pore size of 0.8 micrometers (µm).

Selection and training of riders for observational sampling

All individuals who participate in the survey and the air sampling program will be individuals who normally ride at the BMX track in OU5. In accord with USEPA guidance currently being developed (http://www.epa.gov/nerl/sots/SEAOES-review-draft.pdf), participation will be strictly voluntary, and will be done under informed consent. All personal information regarding the identify and exposures of the participants will be held in confidence by EPA, and any data that is released outside of EPA will be coded in a way that no personal information is disclosed.

Because sample collection requires the volunteers to wear a personal air monitor, all volunteers will be provided a training session on the use of the air sampling equipment. In addition, for safety reasons, each volunteer will be asked to ride for 1-2 practice laps at low bike speed with the equipment attached (with the pump turned off) in order to gain practice riding with the added weight of the equipment.

Personal Air Samples

Each volunteer rider will wear an air filter connected to a calibrated air pump. The filter cassette will be located on the shoulder, pointed downward, to ensure the air collected is similar to that in the breathing zone of the rider.

Based on a similar sampling program performed at the Clear Creek Management Area (CCMA) site (CH2M Hill 2004), it is expected that the air samples will be collected under dusty conditions. Based on this, sampling duration and pump flow rate should be adjusted to yield sample volumes of about 200 liters (L). Assuming that each riding activity lasts about 20 minutes, the pump flow rate should be set to 10 L/minute (L/min).

Stationary Air Samples

Five stationary air samplers will be positioned around the track. Specific sample locations will be determined in the field and will be based on the current configuration of the track and placed so that they do not pose a safety hazard to the BMX riders and/or EPA contractors.

Stationary air sampling should be initiated at approximately the same time as bike riding activities begin. The sampling period should be approximately 3-4 hours, or until riding activities stop. The pump rate should be set to 10 L/minute. Assuming a sample of about 4 hours, this will yield a volume of about 2400 L.

Pump Calibration

Each air sampling pump will be calibrated, using an electronic calibrator, prior to and after use each day using a cassette reserved for calibration (from the same lot of the sample cassettes to be used in the field). For pre-sampling calibration, calibration will be considered complete when ±5 percent of the desired flow rate is attained, as determined by three measurements with the calibrator. For post-sampling, three separate constant flow calibration readings will be obtained and those flow readings will be averaged. If the flow rate changes by more than 5 percent during the sampling period, the average of the pre- and post-sampling rates will be used to calculate the total sample volume.

Samples for which there is more than a 25 percent difference from initial calibration to end calibration will be invalidated. The sample collector will record the pump serial number, sample number, initial flow rate, sample start/end times, sample locations, and final flow rate either in the field logbook or on a field data sheet.

5 LABORATORY ANALYSIS AND REQUIREMENTS

The laboratories used for all sample analysis will have participated in, and acceptably analyzed, the required parameters in the last two proficiency examinations from the National Institute of Standards and Technology/National Voluntary Laboratory Accreditation Program. The laboratory must also analyze project specific performance evaluation samples or other reference materials when requested. These analyses must be performed before any samples are submitted to the laboratory to confirm the laboratory's capabilities and may be subsequently submitted at regular intervals. In addition, the laboratory must participate in the laboratory training program developed by the Libby laboratory team.

5.1 Analytical Methods

All air samples collected as part of this effort will be submitted to a subcontracted laboratory for analysis using the International Organization for Standardization (ISO) TEM method 10312, also known as ISO 10312:1995(E) (CDM 2003), with all applicable project specific modifications, including LB-000016, LB-000019, LB-000028, LB-000029, LB-000029a, LB-000030, LB-000053, and LB-000066a (CDM 2003). All asbestos structures (including not only LA but all other asbestos types as well) that have appropriate diffraction patterns and EDS spectra, and having length greater than or equal to 0.5 um and an aspect ratio ≥ 3:1, will be recorded on the Libby site-specific laboratory data sheets and electronic deliverables.

5.2 Analytical Sensitivity

Personal Air Samples

The target analytical sensitivity for personal air samples is 0.01 cc^{-1}. Assuming a sample volume of 200 L, and assuming the sample can be evaluated without indirect preparation, the number of grid openings needed to achieve the target sensitivity is about 20.

Stationary Air Samples

The target analytical sensitivity for stationary air samples is 0.001 cc^{-1}. Assuming a sample volume of 2400 L, and assuming the sample can be evaluated without indirect preparation, the number of grid openings needed to achieve the target sensitivity of 0.001 f/cc is about 16.

Field Blanks

All air field blanks collected as part of this program will be analyzed by counting a number of grid opens that is approximately equal to the number of grid openings that are analyzed for field samples. It is expected that this will be about 20 grid openings.

5.3 Holding Times

No preservation requirements or holding times are established for air samples collected for asbestos analysis.

5.4 Laboratory Custody Procedures and Documentation

Laboratory custody procedures and documentation will be completed as required by the specifications detailed in Section 4.5 of the SWQAPP (CDM 2007).

5.5 Documentation and Records

Laboratory documentation and records will be completed as required by the specifications detailed in Section 4.7 of the SWQAPP (CDM 2007).

5.6 Data Management

Sample results data will be delivered to the Volpe Center and CDM's Cambridge office both in hard copy and as an electronic data deliverable (EDD) in the most recent project-specific format. Electronic copies of all project deliverables, including graphics, will be filed by project number. Electronic files will be routinely backed up and archived according to individual laboratory processes.

All results, field data sheet information, and survey forms will be maintained in the Libby project database managed by the Volpe Center under the oversight of the Volpe Center database management team.

6 REFERENCES

Amandus, H.E., and Wheeler, R. 1987. The morbidity and mortality of vermiculite miners and millers exposed to tremolite-actinolite: Part II. Mortality. Am. J. Ind. Med. 11:15-26.

Amandus, H.E., Wheeler, P.E., Jankovic, J., and Tucker, J. 1987a. The morbidity and mortality of vermiculite miners and millers exposed to tremolite-actinolite: Part I. Exposure estimates. Am J Ind. Med 11:1-14.

Amandus, H.E., Althouse, R., Morgan, W.K.C., Sargent, E.N., and Jones, R. 1987b. The morbidity and mortality of vermiculite miners and millers exposed to tremolite-actinolite: Part III. Radiographic findings. Am. J. Ind. Med 11:27-37.

CDM (Camp Dresser & McKee, Inc.). 2002. Property Specific Sampling and Analysis Plan , Air and Dust Sampling for the Stimson Lumber Company, Libby Asbestos Site, OU4. Libby, Montana.

CDM (Camp Dresser & McKee, Inc.). 2003. Final Sampling and Analysis Plan, Remedial Investigation, Libby Asbestos Site, Operable Unit 4. May 16.

CDM (Camp Dresser & McKee, Inc.). 2004. Stimson Lumber Additional Sampling – Track/Garden Plots. May 10.

CDM (Camp Dresser & McKee, Inc.). 2007. Site-Wide Quality Assurance Project Plan, Libby, Montana Asbestos Project. *Final Report Date Pending TAU Review*.

CH2M Hill. 2004. Sampling and Analysis Plan for Asbestos Air Sampling, Clear Creek Management Area, San Benito County, California. October 22.

EPA. 2001. EPA Requirements for Quality Assurance Project Plans, QA/R-5. Final. March.

EPA. 2006. Guidance on Systematic Planning Using the Data Quality Objective Process, QA/G-4. February.

IRIS. 2007. Integrated Risk Information System. Maintained and distributed by the US Environmental Protection Agency. Online at: http://cfpub.epa.gov/ncea/iris/index.cfm.

Peipins LA, Lewin M, Campolucci S, Lybarger JA, Miller A, Middleton D, et al. 2003. Radiographic abnormalities and exposure to asbestos-contaminated vermiculite in the community of Libby, Montana, USA. Environ. Health Perspect. 111:1753-1759.

Rohs AM, Lockey JE, Dunning KK, Shulka R, Fan H, Hilbert T, Borton E, Wiot J, Meyer C, Shipley RT, LeMasters GK, Kapol V. 2007. Low level Fiber Induced Radiographic

Changes Caused by Libby Vermiculite: A 25 year Follow-up Study. Am J Respiratory and Critical Care Medicine. Published online December 6, 2007 as doi:10.1164/rccm.200706-814OC.

Sullivan PA. 2007. Vermiculite, Respiratory Disease and Asbestos Exposure in Libby, Montana: Update of a Cohort Mortality Study. Environmental Health Perspectives doi:10.1289/ehp.9481 available online at http://dx.doi.org.

MacDonald, J.C., McDonald, A.D., Armstrong, B., and Sebastien, P. 1986. Cohort study of mortality of vermiculite miners exposed to tremolite. Brit. J. Ind. Med 43:436-444.

ATTACHMENT 1
ACTIVITY SURVEY
OU5 BMX TRACK RIDERS

Participant Code: BMX-xx

Name:_________________________ (*maintain confidential*)

Age:___________________________ *(maintain confidential)*

Date:__________________________

1. What is the type of equipment do you ride at this BMX track (ATV, motorcycle, etc)?

   Equipment type:____

2. On average, how many days per year do you ride at the BMX track in OU5?

   Average days per year spent at this track:___________________

3. On the days that you ride at this BMX track in OU5, how many total hours do you spend at the track, on average?

   Average hours per visit to this track: __________________

4. Of these total hours at the track, how many hours are spent actually riding on the track?

   Average hours spent riding per visit:___________________

5. How old were you when you started using this track?

   Age when riding at this track began:___________________

6. At what age do you expect that you will no longer ride at this track on a regular basis?

   Approximate age when regular riding at this track will cease:_________________